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United States Patent [19]

Grave

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[54] **LIQUID CRYSTAL DISPLAYS UTILIZING POLYMER DISPERSED LIQUID CRYSTAL DEVICES FOR ENHANCED PERFORMANCE AND REDUCED POWER**

[75] Inventor: Duane A. Grave, Marion, Iowa

[73] Assignee: Rockwell Science Center, Thousand Oaks, Calif.

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[56] References Cited

U.S. PATENT DOCUMENTS

4,386,345	5/1983	Narveson et al.	340/703
5,103,328	4/1992	Numao	359/53
5,146,355	9/1992	Prince et al.	359/50
5,406,305	4/1995	Shimomura et al.	345/102
5,428,265	6/1995	Booth et al.	315/158
5,440,324	8/1995	Strickland et al.	340/784
5,570,210	10/1996	Yoshida et al.	359/51
5,815,228	9/1998	Flynn	349/71

OTHER PUBLICATIONS

Duane A. Grave, Scot Olson and Philip Brown, Cockpit Displays II, Proceedings—SPIE—The International Society for Optical Engineering, *Enhanced AMLCD and Backlight for Extended Luminance Range and Sunlight Readability*, vol. 2462, Apr. 19–21, 1995.

Primary Examiner—Xiao Wu
Attorney, Agent, or Firm—Nathan O. Jensen; Kyle Eppel; J. P. O'Shaughnessy

[57] ABSTRACT

Disclosed is an avionics display device for use in the cockpit of an aircraft. The display device includes a liquid crystal display adapted for using a source of light to display information to a viewer and a backlight adapted to controllably provide a portion of the source of light for use by the liquid crystal display in displaying the information. A polymer dispersed liquid crystal (PDLC) device is positioned between the liquid crystal display and the backlight. An ambient light sensor adapted to sense a level of ambient light in the cockpit of the aircraft provides a sensor output indicative of the sensed ambient light level. Luminance control circuitry coupled to the ambient light sensor, to the backlight and to the PDLC device, receives the sensor output and generates as a function of the sensed ambient light level control signals for controlling the intensity of the light provided by the backlight and the transmissivity of the PDLC device.

18 Claims, 5 Drawing Sheets

